ITCS 312: Automata and Formal Languages

Exam 2, First semester 2011/2012, Form: $\boxed{\text{A}}$

Name:

Student Number:

Section:

Section 1. (1 point each)

Mark the following statements with **True** if they are true and **False** otherwise.

In order for an NPDA to accept a word, the stack must be empty.

The grammar $S \rightarrow bS|aaS|SSS|a, SS \rightarrow aaa|bbb|\lambda, A \rightarrow a$ is a context-free grammar.

Given two regular languages, their concatenation is always regular.

Some languages do not have grammars that are un-ambiguous.

An NPDA must read all of the input and reach a final state in order to accept a given input.

Given the language $L = \{a^n b^m : (n+m) \mod 2 = 0\}$, there exists a context-free grammar that generates L.

The intersection of two regular languages is always context-free.

Parsing of a word can be done by finding a valid derivation tree for it.

The language $L = \{a^n b^m : n \leq m\}$ is not context-free.

A right-linear grammar cannot be ambiguous.

Section 2. (5 points each)

1. Find a context-free grammar for the following language $L = \{a^n b^m : n \neq 2m\}$.

2. Find an NPDA for the following language.

$$L = \{w \in \{a,b\}^* : n_a(w) = 3n_b(w)\}$$

3. Show that the following language is not regular $L = \{a^n b^m : 2n \leq m \leq 4n\}$.

4. Show that the following grammar is ambiguous.

$$
\begin{aligned}
S &\rightarrow bAB|AB|bbB \\
A &\rightarrow b|Ab|aaa \\
B &\rightarrow Sa|a
\end{aligned}
$$

5. Find a left-linear grammar equivalent to the following right-linear grammar.

$$
\begin{aligned}
S &\rightarrow aS|aaA|B \\
A &\rightarrow a|aaB|aa \\
B &\rightarrow baA|\lambda
\end{aligned}
$$